

Having described the invention, what is claimed is:

1 **CLAIM 1.**

2 A process for depositing a film onto a bare or unplated zinc or zinc alloy
3 substrate, the process comprising:

4 directly depositing a film onto a portion of the substrate by physical vapor
5 deposition, the film being a metal film, a ceramic film or a combination thereof,

6 wherein the metal film includes chromium, nickel, titanium, zirconium or a
7 combination thereof, and wherein the ceramic film includes a nitride, a carbide,
8 an oxide or a nitroxide of chromium, nickel, titanium, zirconium, or a combination
9 thereof.

1 **CLAIM 2.**

2 The process of Claim 1 wherein the film is a metal film and the metal film in-
3 cludes chromium, nickel or a combination thereof.

1 **CLAIM 3.**

2 The process of Claim 2 wherein the metal film is deposited at a maximum in-
3 ternal reactor pressure of about 5×10^{-2} torr using a DC voltage ranging from about 25
4 Volts to about 600 Volts and at deposition rates of about 200 Angstroms to more
5 than 1,000 Angstroms per minute to obtain film thicknesses ranging from about 1000
6 Angstroms to about 20,000 Angstroms.

1 **CLAIM 4.**

2 The process of Claim 2, wherein the metal film is deposited at a maximum
3 internal reactor pressure of about 5×10^{-2} Torr using a DC voltage ranging from about
4 40 Volts to about 200 Volts at deposition rates of about 400 Angstroms to more than
5 500 Angstroms per minute to obtain film thicknesses ranging from about 2,500 Ang-
6 stroms to about 9,000 Angstroms.

1 **CLAIM 5.**

2 The process of Claim 1 wherein the film is a ceramic film and the ceramic film
3 includes a nitride, a carbide, an oxide or a nitroxide of titanium or zirconium.

1 **CLAIM 6.**

2 The process of Claim 5 wherein the ceramic film is deposited at a maximum
3 internal reactor pressure of about 5×10^{-2} torr using a DC voltage ranging from about
4 25 Volts to about 600 Volts and at deposition rates of about 200 Angstroms to more
5 than 1,000 Angstroms per minute to obtain film thicknesses ranging from about 1000
6 Angstroms to about 20,000 Angstroms.

1 **CLAIM 7.**

2 The process of Claim 5, wherein the ceramic film is deposited at a maximum
3 internal reactor pressure of about 5×10^{-2} Torr using a DC voltage ranging from about
4 40 Volts to about 200 Volts at deposition rates of about 400 Angstroms to more than
5 500 Angstroms per minute to obtain film thicknesses ranging from about 2,500 Ang-
6 stroms to about 9,000 Angstrom.

1 **CLAIM 8.**

2 The process of Claim 1 wherein the film is a ceramic film including a nitride, a
3 carbide, an oxide or a nitroxide of titanium.

1 **CLAIM 9.**

2 The process of Claim 1 wherein the film is a ceramic film including a nitride, a
3 carbide, an oxide or a nitroxide of zirconium.

1 **CLAIM 10.**

2 The process of Claim 1 wherein the film is a ceramic film including a nitride, a
3 carbide, an oxide or a nitroxide of both titanium and zirconium.

1 **CLAIM 11.**

2 The process of Claim 1 wherein the film is a ceramic film including a nitride of
3 chromium, nickel, titanium or zirconium.

1 **CLAIM 12**

2 The process of Claim 1 wherein the film is a ceramic film including a carbide
3 of chromium, nickel, titanium or zirconium.

1 **CLAIM 13.**

2 The process of Claim 1 wherein the film is a ceramic film including a nitroxide
3 of chromium, nickel, titanium or zirconium .

1 **CLAIM 14.**

2 The process of Claim 1 wherein the film is a metal film including chromium.

1 **CLAIM 15.**

2 The process of Claim 1 wherein the film is a metal film including nickel.

1 **CLAIM 16.**

2 The process of Claim 1 wherein the ceramic film has a thickness of from
3 about 1,500 Angstroms to about 20,000 Angstroms.